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At 10.45 she came to cup 3, and I went to bed. At seven o'clock the next morning the larvæ were all removed. In watching this ant I was much struck by the difficulty she seemed to experience in finding her way. She wandered about at times most irresolutely, and, instead of coming straight across from the door of the frame to the cups, kept along the side of the box; so that in coming to cup 3 she went twice as far as she need have done. Again, it is remarkable that she should have kept on visiting the empty cups time after time. I watched for this ant carefully on the following day; but she did not come out at all.

During the time she was under observation, from 1 till 10.45, though there were always ants roaming about, few climbed up the walls of the cups. Five found their way into the (empty) cup 1 and one only to cup 3. It is clear, therefore, that the ant under observation did not communicate her discovery of larvæ to her friends.

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EXPLORATIONS IN COLORADO UNDER PROFESSOR HAYDEN IN 1875.

THE United States Geological and Geographical Survey of the Territories, under the direction of Professor Hayden, during the season of 1875, continued the work of the two previous seasons in Colorado, completing the southern and southwestern portions, including a belt fifteen miles in width of Northern New Mexico and Eastern Utah.

The entire force was divided into seven parties. The district surveyed by the first party, under A. D. Wilson, embraced an area of 12,400 square miles. It contains the foot-hills sloping eastward from the Front Range, the southern continuation of the Saugre de Christo Range, the southern end of the San Luis Valley, the extension of the La Plata Mountains, and the lower country of the Rio San Juan and its tributaries. A small portion of the sedimentary eastern foot-hills was first surveyed, and the work was then carried westward to the mountainous vicinity of the upper Rio Grande. Instead of forming a well-defined, sharply-limited range, the mountains south of the Rio Grande are formed by a high plateau with numerous isolated peaks. Both the plateau and the peaks mentioned are volcanic, showing the characteristic regularity of flows prevalent there. From the position of volcanic beds composing the higher peaks it may be inferred that at one time the summit of the plateau extended to a considerably higher altitude than at present. Towards the southwest it drops off suddenly into the lower country containing Rios Piedra and Pinos. Where the plateau ends, volcanic and sedimentary beds of Cretaceous age appear, extending from the Rio Animas eastward to the border of the district. Above the Cretaceous beds Nos. 2 and 3 is a series of shales and sandstones about three thousand feet in thickness, and containing coal at a number of points, of unknown geological age, though the series were thought to be possibly parallel with the Trinidad coal-bearing strata, and not of Cretaceous age.

The work was continued to the extension of the La Plata Mountains, among which evidences of former glaciers were found. In this region also there are evidences of the former existence of two very large lakes at the close of the volcanic activity there. The work was then connected to the north and northeast with that of 1874, and therewith finished.

The southwestern division, under the direction of W. H. Holmes as geologist, worked over an area of about sixty-five hundred square miles. The section of stratified rocks exposed extends from the lignitic series to the Carboniferous, including about two thousand feet of the former, and slight exposures merely of the latter. The heaviest seam of coal examined in the lignitic beds is twenty-one feet in thickness. In the Cretaceous beds fossils occurred in ten distinct horizons, which Mr. Holmes expects to be able to identify with corresponding ones on the Atlantic slope. The section obtained is the most complete and satisfactory made in Colorado up to this time.

The prehistoric remains in the cañons and lowlands of the southwest are of great interest. Many cliff houses built in extraordinary situations, and still in a fine state of preservation, were examined. A good collection of pottery, stone implements, — the latter including arrow-heads, axes, and ear-ornaments, — some pieces of ropes, fragments of matting, water-jars, corn and beans, and other articles were exhumed from the *débris* of a house. Many graves were found, and a number of skulls and skeletons that may fairly be attributed to the prehistoric inhabitants were added to the collection.

The western or Grand River division was under the charge of Henry Gannett, topographer, with A. C. Peale as geologist. The region surveyed embraces the country drained by the Uncompahgre and Dolores rivers and their branches, and the work extended about thirty miles into Utah, the total area surveyed being about six thousand square miles. The geology of this district is comparatively simple, there being no great uplifts, nor many local disturbances. The sedimentary beds are all included under the Carboniferous, Red beds (Triassic?), Jurassic, and Cretaceous series. On August 15th, the work was brought suddenly to a close by the Indians.

The work of the fourth division, directed by G. R. Bechler, extended over a large area, situated from the foot-hills of the Rocky Mountains to the Upper Arkansas and Eagle rivers, and from a point six miles south of Pike's Peak to within fifteen miles of Long's Peak, including the great mining industries of Colorado.

The party under Mr. Gardner had made but little progress when it was prevented from doing further work by the Indians. One of the stations occupied was very important, namely, the Sierra la Sal Mountain, which enabled Mr. Gardner to secure an excellent set of observations, thus extending the triangulation far into Utah, and connecting the eastern work of the survey with the great Colorado River of the West.

The trip of Mr. Jackson, the photographer of the expedition, to the southwestern portion of Colorado renewed the work of 1874 on the ancient ruins north of the present Moquis Pueblos. Interesting archæological discoveries in the upper San Juan Mesa Verdé and La Plate regions were made by Mr. W. H. Holmes, in addition to his geological work. The ruins occurred only in those cañons which had alluvial bottoms. A strip of bottom land only fifty yards in width at the bottom of the deep cañons would yield maize enough to subsist quite a town. The supposition that they belonged to an agricultural people is strengthened by the fact that in the vicinity of any group of ruins there are also a number of little "cubby-holes," too small for habitations, but very evidently intended for "caches" or granaries, and the large towns contain small apartments that must have been designed for the same use. In one place where grass, cedar, and artemisia flourish, and there is most excellent grazing land, these people must have had herds of sheep or goats which they brought up here to graze during the winter, just as the Ute and Navajos do at the present time; and the towers so frequent in this region were probably built as places of refuge or residence for the herders. Upon the faces of rock near one of these ruins is an inscription chipped in with a sharp-pointed instrument, and covering some sixty square feet of surface. Figures of goats, lizards, and human forms abound, with many hieroglyphical signs. At other points adobe houses of great extent were discovered. One town, running along the face of a perpendicular bluff for three hundred yards, contained seventy-five rooms, with granaries and cisterns. In the centre of the mass was a well-preserved circular apartment, a little below the general level of the others, which was probably an *estrefa.* The goat corrals were inside, between the houses and the bluff. In another ruined town, consisting of houses scattered up and down the De Chelly and Bonito rivers, were great reservoirs in which was found abundant and excellent water.

A week was spent by Mr. Jackson at the Moquis towns, where he obtained photographs of the houses and the inhabitants. The comparison between the work of the prehistoric town-builders and the Moquis was very much in favor of the former, the highest degree of perfection being exhibited in the cliff houses of the Rio Mancos (described in the January NATURALIST), where some of the houses were marvels of finish and durability, while in traveling to the present homes of the Moquis there was found to be a gradual merging of the ancient into the modern style, from the neatly-cut rock and correct angles of the prehistoric race to the comparatively crude buildings now made by the Moquis. Other ruins in different cañons were visited, the most extensive of which were in the cañon and valley of the Montezuma. Here the bottom of the cañons once supported a very thickly settled community. There is in one lateral cañon an almost continuous series of ruins for a distance of twenty-five miles. Throughout the lateral cañons every available defensive point has been utilized, and is now covered with the remains of heavy walls and large blocks of houses.

Another singular feature was the number of holes cut into the perpendicular lower wall of the cañon for the purpose of ascending the rock, holes just large enough to give a hand and foot hold, and leading either to some walled-up cave or to a building erected above. Some of these steps ascended the nearly perpendicular face of the rock for one hundred and fifty or two hundred feet.

The results of this trip were the collection of a large number of utensils, both modern and ancient, stone arrow and spear points, knives and axes, with photographs especially illustrative of the most important ruins, and numerous sketches of everything of note, which will be brought out in detail in the regular publications of the survey.

During the summer, Mr. P. R. Uhler and Dr. A. S. Packard, Jr., were temporarily attached to the survey, and made collections of insects in Colorado. Dr. Packard investigated the ravages of the destructive grasshopper and other injurious insects of Colorado and Utah, with a view to the preparation of a report on the injurious insects of the Territories. He also discovered a new cave-fauna on the shores of Great Salt Lake, and investigated the Alpine insects of the Rocky Mountains.

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RECENT LITERATURE.

WYMAN'S FRESH-WATER SHELL-MOUNDS OF THE ST. JOHN'S RIVER, FLORIDA.[1] — This very valuable contribution to our knowledge of the archæology of North America is modestly asserted by its lamented author to be "a record of what he has observed and a contribution to the knowledge of these ancient relics of a race which has long since passed away." It certainly is all this and more, although "still very incomplete," — a fact which goes far to show how wide a field for exploration and study is open to those devoted to archæological pursuits. The memoir opens with an admirably clear sketch of the characteristic features of the St. John's River, followed by a general description of the mounds, forty-eight in number, the majority of which are found between Lake George and Lake Harney. These shell-mounds, built up exclusively of fresh-water species, are peculiar, in being formed mainly by accumulations of Ampullarias and Paludinas, with a small percentage of mussel shells (Unios), as elsewhere these heaps are entirely formed of Unios, the other shells being either very scantily represented or altogether absent. Those here described "are in almost every case built on the banks of the river, resting either on one of the ridges of sand and river mud, ... or on land slightly raised." The accompanying plate (I.), forming the frontispiece to the memoir, illustrates the shell-mound at Old Enterprise. "From the presence of fire-places, ashes, calcined shells, charcoal, and implements, together with the bones of edible animals and occasionally those of man, found at various depths from top to bottom, and the absence of everything which might have been made by the white man, it seems certain that these mounds were the accumulations by and the dwelling-places of the earliest . . . . inhabitants, during the successive stages of their formation." As bearing upon the question of the antiquity of these mounds and their various contents of human origin, Professor Wyman remarks "that the building of the

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[1] *Fresh-Water Shell-Mounds of the St. John's River, Florida.* By JEFFRIES WYMAN. Memoirs of the Peabody Academy of Science. Volume I. Number 4. Salem, Mass.: Published by the Academy. December, 1875. Royal 8vo, pp. 94. With a map and nine plates.